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In the drawings:

Please replace the originally filed five drawing sheets 1-5 with the attached replacement (substitute) five drawing sheets 1-5.

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REMARKS

Objection to drawings

The drawings have been objected to as having pale lines. Applicant has submitted substitute drawings in which the lines are no longer pale, and requests that the objection be withdrawn.

Claim rejections under 35 USC 101

Claims 1, 4, 6, and 7 have been rejected under 35 USC 101 because the claimed invention is directed to non-statutory subject matter. In light of the amendments made to independent claim 1, from which claims 4, 6, and 7 depend, Applicant submits that these claims are directed to statutory subject matter under 35 USC 101. For instance, claim 1 now includes the processor control transfer that was previously included in claim 2, which was not rejected under 35 USC 101, and thus was directed to statutory subject matter.

Claim rejections under 35 USC 102 and under 35 USC 103

Claims 1, 4-6, 8, 9, 14, and 15 have been rejected under 35 USC 102(b) as being anticipated by "Common Software Model Deployment Initiative System Design Document, Version 1.0," Southwest Research Institute [hereinafter referred to as Southwest]. Claims 2, 3, 7, 12, 13, and 16-20 have been rejected under 35 USC 103(a) as being unpatentable over Southwest in view of Fuchs (5,440,726). Claims 10 and 11 have been rejected under 35 USC 103(a) as being unpatentable over Southwest in view of Fuchs and further in view of Applicant's Admitted Prior Art (APA).

Applicant has substantially amended independent claims 1, 8, and 16, from which the remaining claims ultimately depend. Applicant discusses independent claim 1 as representative of

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the other independent claims, insofar as the patentability of the claimed invention over the cited

prior art is concerned. In particular, the scope of claim 1 has been limited to a worker process

and an executive process within "a single-threaded, interrupt-free diagnostic mode of a firmware

environment." In this environment, "the worker process has processor control while running" and

"the executive process is unable to interrupt running of the worker processor and is unable to

function unless and until the worker process transfers processor control to the executive process."

When the worker process sends a signal to the executive processor, "processor control transfers

from the worker process to the executive processor so that the executive process is able to

function and such that the worker process is unable to function." Implicit and explicit support for

the amendments made to the claimed invention are found in the patent application as filed at least

in paragraphs 33 and 34 on pages 7 and 8.

Applicant now discusses the importance of the amendments made to the claims, and thus

why the prior art of record, either alone or in combination, does not render the claimed invention

unpatentable. The claimed invention is limited to a firmware environment that has a single-

threaded, interrupt-free diagnostic mode. It is noted that neither Southwest nor Fuchs, for

instance, discloses operation within such a mode of such an environment. The patent application

as filed describes this mode as follows.

> Within firmware and other computer operating environments, there
> generally exists a limited-functionality operating mode for performing hardware
> diagnostic testing, which is also known as performing diagnostics. Hardware
> diagnostic environments customarily are single-threaded environments without
> interrupt support, which means that the running process has complete control
> within the environment. Other processes cannot interrupt this process . . . .

(Paragraph [7], pp. 1-2) As claimed, the executive process cannot interrupt the running of the

worker process and is unable to function unless and until the worker process transfers processor

control thereto.

Applicant parenthetically notes that the multitasking of Fuchs in particular is not a "single-

threaded, interrupt-free diagnostic mode of a firmware environment." Indeed, Fuchs implies that

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a multi-threaded, interrupt multitasking environment is required. For instance, Fuchs states that "[i]f the watchdog does not receive another signal from the application process before the end of the specified interval, the watchdog will presume that the application process is hung or has crashed." (Col. 2, ll. 63-66) "Thereafter, the fault tolerant computing system will initiate a recovery of the application process . . . ." (Col. 2, ll. 44-46) In the claimed invention, the executive/watchdog process is unable to function until the worker process transfers processor control to it by sending a signal. However, in Fuchs, even if the watchdog does not receive another signal from the worker/application process, it is able to "presume that the application process is hung or has crashed" and thus can "initiate a recovery of the application process" – i.e., the watchdog is still functioning! This is standard practice of modern, interrupt-driven multitasking environments, as can be appreciated by ordinary skill within the art, where the processor itself is able to switch execution among processes, and transfer processor control to different processes. In a single-threaded, interrupt-free environment, however, this is not possible – once a process has control of the processor, there are no interrupts that can be called to get control from that process, and the processor itself cannot switch control to another process.

This is where the invention comes in. The invention forces the worker process to periodically send a signal to the executive process, which necessarily transfers control to the executive process. At this time, the executive process can determine whether the worker process is correctly functioning, and if not, shut it down. Of course, the invention presumes that the worker process can or will periodically send this signal. As stated in the patent application as filed, "at least while the worker process 404 is sufficiently functioning properly to call the API 406 of the executive process 402, the executive process 402 is able to monitor the functioning of the worker process 404." (Para. [34], p. 8)

Therefore, the invention is very much concerned with single-threaded, interrupt-free diagnostic modes of firmware environments, which are "limited-functionality operating mode[s] for performing hardware diagnostic testing." (Para. [7], p. 1) Applicant submits that any

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patentability inquiry of the claimed invention need take this into account, since the claimed invention is limited to such single-threaded, interrupt-free diagnostic modes. That is, it is not enough to find heartbeat-type prior art and simply import it into or apply it to single-threaded, interrupt-free diagnostic modes of firmware environments, as is now particularly described. (It should also be clear that the claimed invention is not anticipated by any of the cited prior art of record. For instance, the Southwest reference does not teach transfer of processor control, which the Examiner relied upon Fuchs in finding in combination with Southwest. Thus, the discussion here concentrates on why the claimed invention is not obvious in view of the prior art.)

For the claimed invention to be obvious, the prior art of record has to be able to be modified in such a way as to yield the claimed invention. The question is whether Southwest and Fuchs could be modified in such a way as to be operable/workable in the single-threaded, interrupt-free diagnostic mode of a firmware environment that pervades the entirety of the claimed invention. Applicant very humbly but forcefully says no. Black letter law states that "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings are not sufficient to render the claims *prima facie* obvious." (MPEP 2143.01, citing In re Ratti, 123 USPQ 349 (CCPA 1959))

.The Ratti decision is very informative in this regard. In Ratti, the claimed invention required resiliency to operate, whereas one of the prior art references relied upon required rigidity to operate. The CCPA held that the suggested combination of references "would require a substantial reconstruction and redesign of the elements shown" in the primary prior art reference requiring rigidity to operate, and furthermore would require "a change in the basic principle under which" this primary reference "was designed to operate." (MPEP 2143.01)

The teachings of Ratti and MPEP 2143.01 are particularly apt as to the present situation. For instance, Southwest discloses a very complex and sophisticated design document, in which "common software libraries provide a single set of source code for the more common tasks such as socket communications, logging status messages, and communicating with the MDI Data

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Server." (P. 1) The operational concept of Southwest includes "code libraries that can be linked with other MDI system software and computer processes that can be reused within the overall system architecture of the other MDI systems." (P. 2) "The Process Status GUI provides the ability to visually inspect the status of each of the processes defined for a particular subsystem and to control the execution of these processes." (P. 2) This is complicated stuff – at best such a complex and sophisticated software design could be implemented in relation to "single-threaded, interrupt-free diagnostic mode of a firmware environment," which has limited capability, without "substantial reconstruction and redesign." At worst (and more likely), is that Southwest could not be implemented in conjunction with a single-threaded interrupt-free diagnostic mode of a firmware environment, without "chang[ing] the principle of operation of the prior art invention being modified."

For instance, the "Process Status GUI" of Southwest is referred to in the previous paragraph as "provid[ing] the ability to visually inspect the status of each of the processes defined . . . and to control the execution of these processes." However, as has been made clear, this is not possible within a "single-threaded interrupt-free diagnostic mode of a firmware environment," in which a running process has complete control and other processes cannot interrupt this process. For instance, the process status GUI would not be able to visually inspect or control the execution of a running process, since the running process has complete control. Without substantial redesign and reconstruction, Southwest just simply could not work as limited by the claimed invention. It is not a simple matter to say that Southwest could be modified in view of a single-threaded interrupt-free diagnostic mode of a firmware environment (or vice-versa), because Southwest would require substantial redesign and reconstruction to operate in such a mode of such an environment.

Similarly, Fuchs also discloses a complex process monitoring and recovery system. As has been described, Fuchs implies that a watchdog process is able to function even when a signal has not been sent by the monitored application process, since "[i]f the watchdog does not receive

another signal from the application process before the end of the specified interval, the watchdog will presume that the application process is hung or has crashed." (Col. 2, ll. 63-66) Fuchs is predicated, in other words, on the ability of processes to be able to function without having other processes explicitly transferring processor control to them via the sending of a signal. Otherwise, there is no way for Fuchs to "initiate a recovery of the application process" that has failed to send such a signal. (Col. 2, ll. 44-46) Again, without substantial redesign and reconstruction, Fuchs just simply could not work as limited by the claimed invention. It is not a simple matter to say that Fuchs could be modified in view of a single-threaded interrupt-free diagnostic mode of a firmware environment (or vice-versa), because Fuchs would require substantial redesign and reconstruction to operate in such a mode of such an environment.

The sum total of this line of argument is that Applicant submits that the cited prior art of record is not amenable to rendering the claimed invention obvious, which has to do with monitoring a worker process by an executive process in conjunction with a single-threaded, interrupt-free diagnostic mode of a firmware environment. The signal sending or heartbeat sending of the claimed invention is unique because each time a signal or a heartbeat is sent by the worker process is the only time the executive process is able to actually determine whether the worker process is still functioning properly. This is unlike Fuchs, for instance, in which the executive process can determine at any time that the worker process has *stopped sending heartbeats*, and thus at any time determine whether the worker process is still functioning properly.

Finally, Applicant has submitted herewith in a Form 1449 a primer on multitasking. The type of multitasking that Southwest and Fuchs require is "preemptive multitasking," in which "a hardware system . . . can 'interrupt' a running process, and direct the processor to execute a different piece of code." By comparison, the type of multitasking that can at best be provided by a single-threaded, interrupt free diagnostic mode of a firmware environment is "cooperative multitasking," which "must rely on each process to regularly give time to other processors on the

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system," such that a "'hung' process can effectively bring the system to a halt." That is, the monitoring of a worker process by an executive process by the claimed invention is accomplished by the worker process periodically sending a signal to the executive process, so that it can determine whether the worker process is still functioning properly. Southwest and Fuchs do not actually determine whether the worker process is not functioning properly each time a heartbeat is sent. Rather, Southwest and Fuchs determine whether the worker process is not functioning properly when a heartbeat has not been timely sent. This is possible because the executive process overseeing the worker processes is guaranteed to receive processor control at regular intervals in time, consistent with preemptive multitasking.

For example, while Fuchs has been described as requiring preemptive multitasking, Southwest requires preemptive multitasking, too. On page 46, Southwest says that "the check for late heartbeats routine searches the process status shared memory for processes that have failed to heartbeat within the configured maximum heartbeat window." This check for late heartbeats routine would be performed by the executive process, using the terminology of the claimed invention. So, say the worker process that has failed to heartbeat is in the claimed invention. In the claimed invention, the executive process only gets to run when the worker process sends a signal (heartbeat), and thus can only see if the worker process is working properly when such processor control is shifted to the executive process. But, in Southwest, the executive process is being described as being able to determine whether a worker process is late in sending its heartbeat – in the claimed invention, Southwest could not do this, because if a worker process does not send in a heartbeat (signal), the executive process cannot run, period, and thus could not determine any type of lateness!

Applicant sincerely and very much hopes that the discussion that has been provided is sufficient to explain to the Examiner why Fuchs, Southwest, and the other cited prior art do not render the claimed invention obvious, because these references would not work in a single-threaded, interrupt-free diagnostic mode of a firmware environment without substantial redesign

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and reconstruction. Applicant invites the Examiner to call Applicants' representative, Michael Dryja, if this discussion does not persuade him why Fuchs, Southwest, and the other cited prior art do not render the claimed invention obvious. Furthermore, Applicant invites the Examiner to indicate if the claiming of the subject invention is "close" to acceptable in some ways, and which otherwise would become patentable in the Examiner's eyes if reworded in a different way. That is, Applicant is amenable to modification of the claims should such modification render the claimed invention allowable.

                                        Respectfully Submitted,

July 26, 2005
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